University Fees and the Demand for stem Degrees

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The 2006 increase in university tuition in the U.K. was followed by a 3-4% reduction in the proportion of students choosing STEM degrees, due either to a change in the composition of students, or to similar students selecting away from STEM subjects. This paper tests the latter hypothesis, estimating the effect of the fees for comparable students using propensity score matching on a rich set of covariates. Results suggest that the change was entirely driven by compositional changes. (JEL : I22, I28, I23)

Keywords: Educational Finance, Subject Choice, Higher Education

1 Introduction

Half of the countries monitored by the OECD have increased university fees since 1995[1] but little is known about the effects on subject choice[2]. When the annual price of tertiary education in the U.K. increased from £1,200 to £3,000 in the academic year 2006/7, the proportion of students starting degrees in STEM subjects was reduced by 3-4%[3]. This paper tests the hypothesis that comparable students changed from STEM subjects in response to increased fees, against the null that subject choice was driven by compositional changes in the student body. Related evidence is sparse, and mainly focused on targeted aid programs based on ability or financial need (Cornwell et al, 2005; Stater, 2011; Sjoquist and Winters, 2015) or programs confined to a single institution (Rothstein and Rouse, 2011). Stage (2015) studies a policy in which 142 universities increased the price of individual programs, finding that this generally reduced demand. To my knowledge, this paper is the first evidence on the effect of a universal increase in the price of tertiary education on subject choice.

2 Background and Methodology

Universities in England operate a centralised admissions system. Students pay a small fee, select five courses, and submit a single personal statement explaining their interest in their chosen subject. This creates a strong incentive for students to apply for the same subject at

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[1]OECD Education at a Glance 2011, available at `https://www.oecd.org/edu/skills-beyond-school/`

[2]See Deardon, Fitzsimons, and Wyness (2011) for a review of evidence on participation. See Altonji, Arcidiacono, and Maurel (2016) for a review of evidence on the determinants of subject choice.

[3]Author's calculation based on data from the U.K. Higher Education Statistics Authority.

different universities. Loans are government-backed, available to all students holding a place, and are almost interest free. Repayment is at a rate of 9% of any gross income above £15,000 and is generally organised though the tax system. Tuition fees for students are set by the government and were approximately £1,200 in 2005/6, and £3,000 from the 2006/7 academic year.

2.1 Data

Data comes from the 2003 to 2008 waves of the British Labour Force Survey. The sample consists of English students aged seventeen and eighteen who have just enrolled in university. Those students for whom there is no parental information, and those that do not have A-level qualifications are removed from the sample. The final dataset contains 1,189 observations in total: 798 for the control group observed before 2006, and 391 for the treated group observed after 2005.

2.2 Testing

Testing the hypothesis requires that students observed before and after 2006 are as comparable as possible. There are two possible challenges. The first is differential effects of fees on university enrolment, and the second is deferred entry (Deardon et al, 2011). Both could leave the comparison group more likely to contain students from wealthier families. A propensity score matching methodology is used to manage these selection issues. The key assumption is selection on observables (CIA), and the data provide a very rich set of pre-treatment covariates on which to estimate the propensity score. Variables used can be seen in Table 1. The largest difference between groups is in gender, with males representing 40% of the treated sample and 46% of the control sample. A second assumption is that nothing except for the tuition fee increase happened between 2003 and 2008 that might have affected the subject choice decision. There were no other changes that might have affected English students directly, but there were funding changes in Scotland and Wales in the period. Indirect effects would be very small as the proportions of Scottish and Welsh students at English universities are one and two percent respectively. The financial crisis only seriously affected youth unemployment in 2009, which is outside of the sample. However, data on regional level unemployment is included to control for possible macroeconomic effects on subject choice[4].

2.3 Estimation

Estimation of the propensity score is conducted using *pscore*[5]. This program estimates the probability that an individual is assigned to treatment with a probit estimator. The propensity scores for the treated and control groups can be seen in Figure 1. As anticipated, the propensity distribution of the treated group is to the right of the distribution for controls. The region of common support is [0.10, 0.70]. For robustness, estimates of the ATT come from four matching methodologies: nearest neighbour matching with replacement, radius matching, stratification, and kernel matching.

3 Results and Discussion

The null hypothesis is that the 2006 increase in tuition fees had no effect on the subject choice decisions individuals. Results are shown in Table 2. They suggest that there was no effect of the increase in tuition fees on subject choice, once individual and regional effects are taken into account. Choice of matching methodology does not substantially affect either the central

[4]My thanks go to an anonymous referee who suggested this addition to the set of pre-selection controls.

[5]Becker and Ichino (2002)

estimate or conclusions of the tests. The exercise was also repeated using only a region of 'thick' support in the region [0.2, 0.6]. Again, this had no effect on the results of the analysis. We therefore fail to reject the null-hypothesis and provisionally accept the alternative hypothesis - that any decrease in the proportion of students studying STEM subjects was due to compositional changes in the student cohort.

4 Conclusion

This paper estimated the effect of an increase in the price of tuition on the propensity to study a degree in science, technology, engineering or maths, using variation from the 2006 increase of tuition fees in England and a matching methodology. Results suggest that the increase from £1,200 to £3,000 had no effect on individual decisions to choose STEM degrees. The decrease in the proportion of students studying STEM subjects after the fee increase is likely due to a change in the composition of students choosing to enter tertiary education.

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5 Tables

Table 1: Characteristics of the Treated and Control Groups

Variable	Treated	Matched Controls	All Controls
Male	40%	46%	46%
Black	2%	1%	1%
Asian	9%	10%	10%
Family Size	1.8	1.6	1.6
Parent: Highest Income	21%	24%	26%
Parent: High Income	26%	29%	29%
Parent: Medium Income	12%	11%	11%
Parent: Degree	25%	25%	25%
Parent: HNC	10%	9%	9%
Parent: A-levels	7%	7%	7%
Parent: GCSE	22%	17%	17%
Parent: Arts Profession	1%	0%	0%
Parent: Business Profession	7%	7%	7%
Parent: Stem Profession	21%	24%	24%
Parent: Unemployed	3%	3%	3%
Region: North	25%	25%	25%
Region: Merseyside	3%	4%	4%
Region: East Midlands	9%	6%	6%
Region: West Midlands	11%	11%	13%
Region: Eastern	11%	11%	11%
Region: London	14%	15%	15%
Region: South East	19%	19%	18%
Region: South West	9%	8%	7%
Observations	391	836	798

Notes : Data from the Labour Force Survey 2003-2008

Table 2: The Effect of the 2006 Fee Increase on Choosing a STEM Degree

Estimator	Treated	Control	ATT
Nearest Neighbour Matching	391	279	−0.00
			(0.042)
Radius Matching	391	798	0.01
			(0.029)
Stratification	391	798	0.01
			(0.031)
Kernel Matching	391	798	−0.01
			(0.026)

Notes: *, **, *** indicate p < 0.10, 0.05, 0.01. Bootstrapped standard errors for Kernel Matching estimates.